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HSU, JONI	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/729,684	HONG ET AL.	
	Examiner	**Art Unit**	
	Joni Hsu	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on May 22, 2006.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-26 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-26 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. In light of the amendments to Claim 1, the 35 U.S.C. 112, second paragraph rejection of Claim 1 has been withdrawn.

2. Applicant's arguments filed May 22, 2006 have been fully considered but they are not persuasive.

3. Applicant argues that in the claimed embodiments of the present invention, the two-pass rendering operation makes an operational determination on a per-primitive basis. In contrast, Gannett (US006118452A) describes a different sort of two-pass rendering operation, wherein an operation determination is made on a per-pixel basis (page 10, paragraph 3).

In reply, the Examiner disagrees. Gannett discloses that each primitive is converted into fragments (*vertex data 152 enters the primitive assembly processing stage 160 wherein the vertices are converted into primitives*, Col. 7, lines 12-14; *in the rasterization processing stage 164, geometric data 152 is converted into fragments*, Col. 7, lines 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span

has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Since this is done for each span in each primitive, the operation is determining, for each primitive, whether the primitive has at least one visible pixel.

4. With regard to Claim 8, Applicant argues that Gannett does not teach processing only a limited set of graphic data for each primitive (page 12, paragraph 3).

In reply, the Examiner disagrees. Gannett teaches that the span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment (Co. 13, line 65-Col. 14, line 9). Therefore, during the first pass, only a limited set of graphic data for each primitive is processed since only the visibility pretest operations are performed during the first pass. During the second pass, a full set of graphic data is processed for only those primitives determined to have at least one visible pixel since all of the per-fragment operations are performed on these primitives.

5. With regard to Claim 21, Applicant argues that Gannett fails to disclose logic to limit the processing of graphic data in a first pass within a graphic pipeline, or logic configured to render, in a second pass within the graphic pipeline, only the primitives determined in the first pass to have at least one visible pixel (page 13, paragraph 2).

In reply, the Examiner disagrees. Since in the first pass the span is traversed during the processing performed by the visibility pretest module 202 to determine the visibility of the pixels

to determine which spans have no visible pixels and eliminates the processing of spans that have no visible pixels (Col. 13, line 65-Col. 14, line 9), the first pass has logic configured to limit the processing of graphic data for each of the plurality of primitives. Figure 2 shows fragment operations 168, which is considered to be the graphic pipeline, and the visibility pretest module 202 is a part of the graphic pipeline. In the second pass within the graphic pipeline, only the spans determined in the first pass to have at least one visible pixel are rendered (Col. 14, lines 3-9).

6. With regard to Claim 1, Applicant argues that Gannett describes a two-span traversal of a certain graphic span, and a span is only a portion of a primitive. Therefore, traversing a span twice, is not the same as processing a primitive by "passing a full set of graphic data for each primitive" through the graphic pipeline (page 15, paragraph 2).

In reply, the Examiner disagrees. Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive. During the second pass, a full set of graphic data is processed for only those spans determined to have at least one visible fragment since all of the per-fragment operations are performed on these spans (Col. 13, line 65-Col. 14, line 9). Since this is done for each span in each primitive, Gannett discloses passing a full set of graphic data for each primitive determined to have at least one visible fragment.

7. With regard to Claim 13, Applicant argues that since Gannett does not disclose a compressed z-buffer, then it cannot properly disclose the structure of the claimed two-pass operation (page 16, paragraph 2).

In reply, the Examiner disagrees. Gannett still discloses a two-pass operation, only the two-pass operation builds a z-buffer (302, Figure 3; Col. 13, line 65-Col. 14, line 9; Col. 12, lines 4-13; Col. 9, lines 35-43) and not a compressed z-buffer. Greene (US005579455A) is combined with Gannet for its teaching of a two-pass operation building a compressed z-buffer (Col. 4, lines 30-37, 43-46; Col. 5, lines 51-61 in Greene).

8. With regard to Claim 14, Applicant argues that Gannett does not disclose a system that is structured to perform a two-pass graphics processing approach. Gannett operates of either a per-pixel basis or a per-fragment basis, and does not operate on a per-primitive basis (page 17).

In reply, the Examiner disagrees. Gannett does disclose a system that is structured to perform a two-pass graphics processing approach (Col. 13, line 65-Col. 14, line 9). Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Since this is

done for each span in each primitive, the operation is determining, for each primitive, whether the primitive has at least one visible pixel.

9. Applicant argues that the motivations used for combining the references are improper or deficient (page 18, paragraph 1).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

In this case, Greene teaches that the motivation for modifying the z-buffer of Gannett so that it is a compressed z-buffer is that this has the advantage of rejecting hidden geometry very quickly and having an algorithm which is much faster than traditional ray-casting or z-buffering (Col. 3, line 61-Col. 4, line 4 in Greene).

Duluk (US006476807B1) teaches that the motivation for modifying the z-record of Gannett so that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels is that this has the advantage of calculating an accurate z value (Col. 31, lines 36-63 in Duluk).

Griffin (US005990904A) teaches that the motivation for including ensuring that the primitive does not render to zero pixels and a compressed z-buffer is that this has the advantage

of considerably reducing the amount of data required, allowing practical implementation of a much more sophisticated anti-aliasing algorithm (Col. 2, line 61-Col. 3, line 5; Col. 9, lines 34-54 in Griffin).

10. Applicant argues that improper hindsight is used to combine the references (page 20, paragraph 3).

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Claim Rejections - 35 USC § 101

11. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-13 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 1-13 are directed to a method of rendering graphic primitives, but these claims do not set forth an application of the method to produce a tangible result (i.e. using the result

(determined visible pixels) to display visible pixels). The claimed invention as a whole must accomplish a practical application. That is, it must produce a "useful, concrete and tangible result (*State Street*, 149 F.3d at 1373, 47 USPQ2d at 1601-02). The tangible requirement requires that the claim must set forth a practical application of the 101 judicial exception to produce a real-world result (*Benson*, 409 U.S. at 71-72, 175 USPQ at 676-77). See MPEP 2106 II A. Since there is no tangible result recited in these claims, these claims are directed to non-statutory subject matter.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. Claims 8-11, 21, 23, 25, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Gannett (US006118452A).

14. With regard to Claim 8, Gannett teaches that the span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment (Co. 13, line 65-Col. 14, line 9). Therefore, during the first pass, only a limited set of

graphic data for each span is processed since only the visibility pretest operations are performed during the first pass. During the second pass, a full set of graphic data is processed for only those spans determined to have at least one visible fragment since all of the per-fragment operations are performed on these primitives. Gannett discloses that each primitive is converted into fragments (*vertex data 152 enters the primitive assembly processing stage 160 wherein the vertices are converted into primitives*, Col. 7, lines 12-14; *in the rasterization processing stage 164, geometric data 152 is converted into fragments*, Col. 7, lines 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Therefore, Gannett describes a method of rendering a plurality of graphic primitives comprising processing, within a graphic pipeline (Col. 3, lines 15-30; Col. 6, lines 6-9), only a limited set of graphic data for each primitive, wherein each primitive comprises a plurality of pixels (Col. 13, lines 55-59; Col. 13, line 65-Col. 14, line 9); determining, for each primitive, whether the primitive has at least one visible pixel; processing, within the graphic pipeline, a full set of graphic data for only those primitives determined to have at least one visible pixel (Col. 13, line 65-Col. 14, line 5).

15. With regard to Claim 9, Gannett describes setting a visibility indicator for each pixel determined to have at least one visible pixel (*visibility pretest controller 308 sets or clears the bit*

in accordance with whether the fragment passed or failed all of the visibility pretests, Col. 14, lines 18-22; *indicating whether a pixel associated with each fragment will not be visible*, Col. 3, lines 46-55).

16. With regard to Claim 10, Gannett describes that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory (*visible pretest module 202 receiving the various clear control commands and values from the frame buffer*, Col. 13, lines 16-19; Col. 14, lines 13-22).

17. With regard to Claim 11, Gannett describes that the processing only a limited set of graphic data more specifically comprises processing only location-related data (Col. 13, lines 50-55; Col. 14, lines 35-44).

18. With regard to Claim 21, Gannett discloses that in the first pass the span is traversed during the processing performed by the visibility pretest module 202 to determine the visibility of the pixels to determine which spans have no visible pixels and eliminates the processing of spans that have no visible pixels (Col. 13, line 65-Col. 14, line 9), the first pass has logic configured to limit the processing of graphic data for each of the plurality of primitives. In the second pass within the graphic pipeline, only the spans determined in the first pass to have at least one visible pixel are rendered (Col. 14, lines 3-9). Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13,

line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Therefore, Gannett describes a graphics processor comprising logic configured to limit the processing of graphic data for each of a plurality of primitives, in a first pass within a graphic pipeline (Col. 3, lines 15-30; Col. 6, lines 6-9; Col. 13, lines 50-55; Col. 13, line 60-Col. 14, line 9), wherein the limited processing determines whether the primitive has at least one visible pixel (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22), wherein each primitive comprises a plurality of pixels (Col. 13, lines 55-59); logic configured to render, in a second pass within the graphic pipeline, only the primitives determined in the first pass to have at least one visible pixel (Col. 13, line 60-Col. 14, line 9).

19. With regard to Claim 23, Gannett describes that the logic configured to limit the processing of graphic data is within a parser (114, Figure 1A; Col. 13, lines 50-55).

20. With regard to Claim 25, Gannett describes logic for setting a visibility indicator for each primitive processed in the first pass (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22).

21. With regard to Claim 26, Gannett describes logic configured to evaluate the visibility indicator for each primitive prior to submitting the primitive to the logic configured to render in the second pass (Col. 13, line 60-Col. 14, line 9).

22. Thus, it reasonably appears that Gannett describes or discloses every element of Claims 8-11, 21, 23, 25, and 26 and therefore anticipates the claims subject.

Claim Rejections - 35 USC § 103

23. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

24. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

25. Claim 1-3, 6, 7, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Gannett (US006118452A) in view of Greene (US005579455A).

26. With regard to Claim 1, Gannett teaches that the span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment (Co. 13, line 65-Col. 14, line 9). Therefore, during the first pass, only a limited set of graphic data for each span is processed since only the visibility pretest operations are performed during the first pass. During the second pass, a full set of graphic data is processed for only those spans determined to have at least one visible fragment since all of the per-fragment operations are performed on these primitives. Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Therefore, Gannett describes a multi-pass method of rendering a plurality of graphic primitives comprising in a first pass: passing only a limited set of graphic data for each primitive through a graphic pipeline (Col. 3, lines 15-30; Col. 6, lines 6-9; Col. 13, lines 50-55; Col. 13, line 60-Col. 14, line 9); processing the limited set of data to build a z-buffer, the z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (302, Figure 3; Col. 12, lines 4-13; Col. 9, lines 35-43); setting a

visibility indicator, for each primitive, if any pixel of the primitive is determined to be visible (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22); in a second pass: for each primitive, determining whether the associated visibility indicator for that primitive is set; discarding, without passing through the graphic pipeline, the primitives for which the associated visibility indicator is not set; passing a full set of graphic data for each primitive determined to have the associated visibility indicator set (Col. 13, line 60-Col. 14, line 9); and performing a z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the z-buffer (222, Figure 2; Col. 12, lines 4-13; Col. 9, lines 35-43).

However, Gannett does not teach that the z-buffer is a compressed z-buffer and performing a two-level z-test. However, Greene describes a multi-pass method of rendering a plurality of graphic primitives comprising in a first pass: passing a set of graphic data for each primitive through a graphic pipeline (Col. 4, lines 38-49). According to the disclosure of this application, a compressed z-buffer provides condensed depth information for multiple pixels [0023]. Greene describes processing the set of data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (Col. 4, lines 30-37; Col. 5, lines 51-61); in a second pass: discarding, without passing through the graphic pipeline, the primitives that are not visible (Col. 4, lines 43-46); passing a set of graphic data for each primitive that are visible; and performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level

of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of an associated macropixel are visible (Col. 4, lines 46-49; Col. 6, lines 20-36).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Gannett so that the z-buffer is a compressed z-buffer and performing a two-level z-test as suggested by Greene because Greene suggests the advantage of rejecting hidden geometry very quickly and having an algorithm which is much faster than traditional ray-casting or z-buffering (Col. 3, line 61-Col. 4, line 4).

27. With regard to Claim 2, Gannett describes that passing only a limited set of graphic data more specifically comprises passing only location-related data through the pipeline (Col. 13, lines 50-55; Col. 14, lines 35-44).

28. With regard to Claim 3, Gannett describes that location-related data comprises X, Y, Z and W values (Col. 1, lines 29-33; Col. 13, lines 50-55).

29. With regard to Claim 6, Gannett describes that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory (Col. 13, lines 16-19; Col. 14, lines 13-22).

30. With regard to Claim 7, Gannett describes that the discarding is performed by a parser (202, Figure 2; Col. 10, lines 36-38).

31. With regard to Claim 13, Gannett teaches that the span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment (Co. 13, line 65-Col. 14, line 9). Therefore, during the first pass, only a limited set of graphic data for each span is processed since only the visibility pretest operations are performed during the first pass. During the second pass, a full set of graphic data is processed for only those spans determined to have at least one visible fragment since all of the per-fragment operations are performed on these primitives. Gannett discloses that each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Therefore, Gannett describes a method of rendering a plurality of graphic primitives comprising processing in a first pass, within a graphic pipeline, only a limited set of graphic data for each primitive (Col. 3, lines 15-30; Col. 6, lines 6-9; Col. 13, lines 50-55; Col. 13, line 60-Col. 14, line 9), wherein each primitive comprises a plurality of pixels (Col. 13,

lines 55-59); processing the limited set of data to build a z-buffer, the z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (302, Figure 3; Col. 12, lines 4-13; Col. 9, lines 35-43); in a second pass, within the graphic pipeline, performing a z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer (222, Figure 2; Col. 12, lines 4-13; Col. 9, lines 35-43).

However, Gannett does not teach that the z-buffer is a compressed z-buffer and performing a two-level z-test. However, Greene describes a multi-pass method of rendering a plurality of graphic primitives comprising in a first pass: passing a set of graphic data for each primitive through a graphic pipeline (Col. 4, lines 38-49). According to the disclosure of this application, a compressed z-buffer provides condensed depth information for multiple pixels [0023]. Greene describes processing the set of data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (Col. 4, lines 30-37; Col. 5, lines 51-61); in a second pass: discarding, without passing through the graphic pipeline, the primitives that are not visible (Col. 4, lines 43-46); passing a set of graphic data for each primitive that are visible; and performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of a macropixel are visible (Col. 4, lines 46-49; Col. 6, lines 20-36), as discussed in the rejection for Claim 1.

32. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Gannett (US006118452A) and Greene (US005579455A) in view of Duluk (US006476807B1).

33. With regard to Claim 4, Gannett and Greene are relied upon for the teachings as discussed above relative to Claim 1. Gannett describes that each z-record comprises a coverage mask, the coverage mask indicating which of the plurality of pixels are visible for the current primitive (318, Figure 3; *sets or clears the bit in the fragment visibility mask 318 associated with each fragment in accordance with whether the fragment passed or failed all the visibility pretests incorporated in the pretest modules 301*, Col. 14, lines 13-22; Col. 12, lines 4-21; Col. 3, lines 46-50).

However, Gannett does not teach that the z-buffer is a compressed z-buffer. However, Greene describes that the z-buffer is a compressed z-buffer (Col. 4, lines 30-37; Col. 5, lines 51-61), as discussed in Claim 1.

However, Gannet and Greene do not teach that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels. However, Duluk describes that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels (Col. 31, lines 45-57).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the devices of Gannett and Greene so that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels as suggested by Duluk because Duluk suggests that this is needed in order to have an accurate z

value. With an accurate z it is known that the z value represents a surface that is known to be visible and anything in front of it is visible and everything behind it is obscured, at that point in the process (Col. 31, lines 36-63).

34. With regard to Claim 5, Gannett describes that each z-record comprises a coverage mask, the coverage mask indicating which of the plurality of pixels are visible for the current primitive (318, Figure 3; Col. 14, lines 13-22; Col. 12, lines 4-21; Col. 3, lines 46-50).

However, Gannett does not teach that the z-buffer is a compressed z-buffer. However, Greene describes that the z-buffer is a compressed z-buffer (Col. 4, lines 30-37; Col. 5, lines 51-61) and performing a two-level z-test (Col. 4, lines 46-49; Col. 6, lines 20-36), as discussed in Claim 1.

However, Gannett and Greene do not teach that each compressed z-record comprises two minimum z values for the plurality of pixels and two maximum z values for the plurality of pixels. However, Duluk describes that each z-record comprises a minimum z value for the plurality of pixels and a maximum z value for the plurality of pixels for the z-test (Col. 31, lines 45-57). Combining Duluk with Greene, which teaches performing a two-level z-test, it would be obvious to modify the device of so that each compressed z-record comprises two minimum z values for the plurality of pixels and two maximum z values for the plurality of pixels. This would be obvious for the same reasons given in the rejection for Claim 4.

35. Claims 12, 14-20, 22, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Gannett (US006118452A) in view of Griffin (US005990904A).

36. With regard to Claim 12, Gannett is relied upon for the teachings as discussed above relative to Claim 8. Gannett describes that the determining whether the primitive has at least one visible pixel ensures that the primitive does not fail a z-buffer test (Col. 9, lines 35-43; Col. 12, lines 4-21), ensures that all pixels of the primitive are not culled, and ensures that all pixels of the primitive are not clipped (Col. 7, lines 24-38).

However, Gannett does not teach a compressed z-buffer and ensuring that the primitive does not render to zero pixels. According to the disclosure of this application, a zero-pixel primitive is a primitive that, when rendered, consumes less area than one pixel of visibility [0024]. Griffin describes a compressed z-buffer (Col. 9, lines 34-54) and ensuring that the primitive does not render to zero pixels (Col. 2, line 61-Col. 3, line 5; Col. 5, lines 26-42).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Gannett to include ensuring that the primitive does not render to zero pixels as suggested by Griffin because Griffin suggests the advantage of being able to perform anti-aliasing to that anomalies such as jaggy edges in the rendered image do not result (Col. 2, line 61-Col. 3, line 5). It would have been obvious to modify the device to include a compressed z-buffer because Griffin suggests the advantage of considerably reducing the amount of data required, allowing practical implementation of a much more sophisticated anti-aliasing algorithm (Col. 9, lines 34-54).

37. With regard to Claim 14, Gannett does disclose a system that is structured to perform a two-pass graphics processing approach (Col. 13, line 65-Col. 14, line 9). Gannett discloses that

each primitive is converted into fragments (Col. 7, lines 12-14, 56-57), and then the two-pass rendering operation makes an operational determination on a per-span basis for each span in each primitive (Col. 13, line 65-Col. 14, line 9). Each span consists of a plurality of fragments, and one fragment corresponds to a single pixel (Col. 13, lines 55-59), and therefore each span consists of pixels. The two-pass rendering operation makes an operational determination of a per-span basis for each span in each primitive, and determining, for each span, whether the span has at least one visible pixel (Col. 13, line 65-Col. 14, line 9). Since this is done for each span in each primitive, the operation is determining, for each primitive, whether the primitive has at least one visible pixel. Therefore, Gannett describes a graphics processor comprising first-pass logic configured to deliver to a graphic pipeline, in a first pass, only a limited set of graphic data for each primitive (Col. 3, lines 15-30; Col. 6, lines 6-9; Col. 13, lines 50-55; Col. 13, line 60-Col. 14, line 9), wherein each primitive comprises a plurality of pixels (Col. 13, line 65-Col. 14, line 9); logic configured to process the limited set of graphic data for each primitive to create a z-buffer (302, Figure 3; Col. 12, lines 4-13; Col. 9, lines 35-43); logic configured to determine, for each primitive, whether the primitive has at least one visible pixel (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22); second-pass logic configured to deliver to the graphic pipeline, in a second pass, a full set of graphic data for only those primitives determined to have at least one visible pixel, the second-pass logic further configured to inhibit the delivery of graphic data to the graphic pipeline for primitives not determined to have at least one visible pixel (Col. 13, line 60-Col. 14, line 9).

However, Gannett does not teach that the z-buffer is a compressed z-buffer. However, Griffin describes that the z-buffer is a compressed z-buffer (Col. 9, lines 34-54), as discussed in the rejection for Claim 12.

38. With regard to Claim 15, Gannett describes that the first-pass logic and second-pass logic are contained within a parser (202, Figure 2; Col. 13, line 60-Col. 14, line 9).

39. With regard to Claim 16, Claim 16 is similar in scope to Claim 12, and therefore is rejected under the same rationale.

40. With regard to Claim 17, Gannett describes logic for setting a visibility indicator for each primitive determined to have at least one visible pixel (308; *visibility pretest controller 308 sets or clears the bit in accordance with whether the fragment passed or failed all of the visibility pretests*, Col. 14, lines 18-22).

41. With regard to Claim 18, Gannett describes that the visibility indicator includes a single bit in a frame-buffer memory (Col. 13, lines 16-19; Col. 14, lines 13-22).

42. With regard to Claim 19, Gannett describes logic configured to associate each primitive processed in the first pass of the data with a distinct visibility indicator (Col. 14, lines 18-22).

43. With regard to Claim 20, Gannett describes logic configured to evaluate, for each primitive presented for processing in the second pass, a status of the visibility indicator associated with the given primitive (Col. 13, line 60-Col. 14, line 9).

44. With regard to Claim 22, Claim 22 is similar in scope to Claim 12, and therefore is rejected under the same rationale.

45. With regard to Claim 24, Gannett describes logic configured to build a z-buffer of data from processing of the graphic data in the first pass (302, Figure 3; Col. 12, lines 4-13; Col. 9, lines 35-43).

However, Gannett does not teach that the z-buffer is a compressed z-buffer. However, Griffin describes that the z-buffer is a compressed z-buffer (Col. 9, lines 34-54), as discussed in the rejection for Claim 12.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joni Hsu whose telephone number is 571-272-7785. The examiner can normally be reached on M-F 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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